

Self-Generation Incentive Program Renewable Generation Workshop

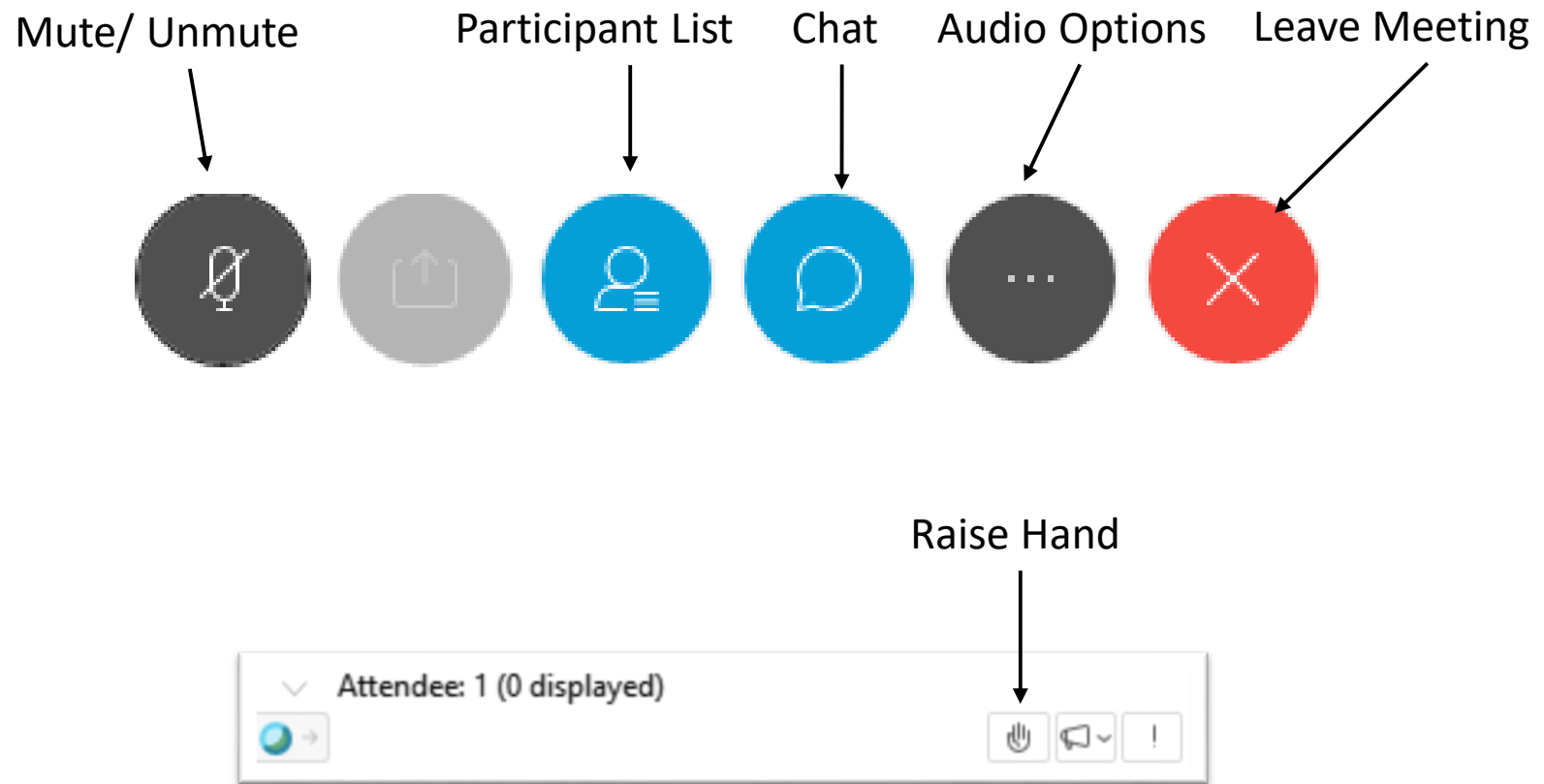
November 12, 2020



California Public
Utilities Commission

Workshop Logistics

- Today's presentations (.pdf) and agenda are available on the WebEx link under “Event Material”
- Please submit questions for speakers in the Chat box or raise your hand to be unmuted by staff
- Questions will be read aloud by staff (Reminder: Mute back!)



Workshop Objective and Next Steps

Objective: To explore in more detail options for developing rules to ensure proper tracking of renewable fuel sources and optimize the GHG reductions of renewable generation technologies under SGIP.

Next Steps:

- **Comments Due November 18, 2020** on Assigned Commissioner's Ruling Seeking Party Comment on Renewable Generation Fuels and Technologies.
- **Q1 2021**- Proposed decision on renewable generation technologies.

Legislative and Procedural Background

PU Code 379.6(a)(1) and Decision (D.) 16-06-055 codify three main SGIP goals:

- *Environmental goals – reduce GHGs/criteria air pollutants and integrate renewables*
- Grid Support goals – reduce or shift peak demand, reduce grid costs, provide ancillary services
- Market transformation

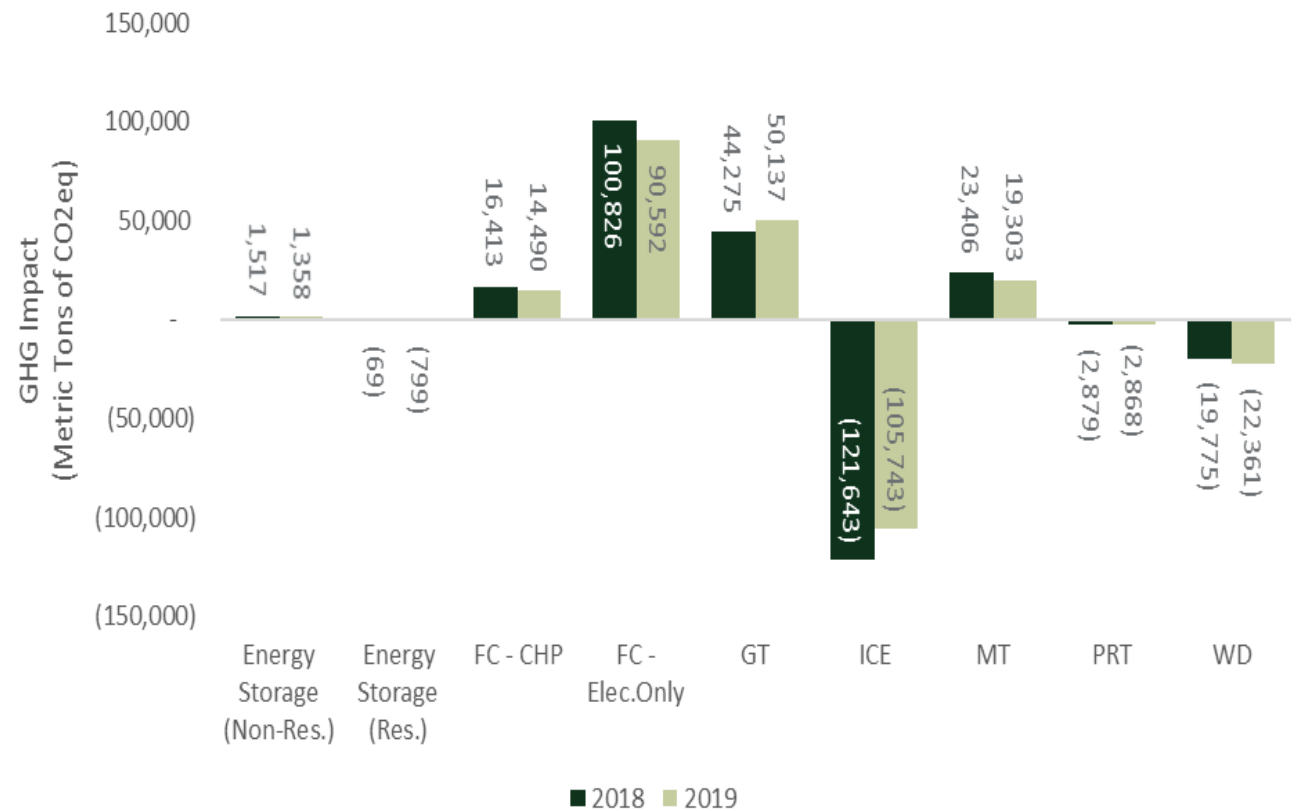
PU Code 379.6(m) requires that, as of January 1, 2020, **all SGIP generation technologies use only renewable fuels.**

D.20-01-021 (issued January 2020):

- Continues the requirement for a minimum 10-year biogas contract for all generation projects using directed biogas.
- Pauses acceptance of incentive applications for generation technologies using collect/use/destroy (flared) - baseline renewable fuels.
- Ordering Paragraph 16: All new renewable generation projects receiving SGIP incentives must use only renewable fuels on an ongoing basis and **for as long as the equipment is in use.**

DRAFT 2018-19 SGIP Impact Evaluation Findings

- The draft report suggests that , for the first time since 2010, SGIP projects resulted in a net GHG increase: over 42 thousand metric tons of CO₂eq in both 2018 and 2019.
- In general, once directed biogas projects fulfill their 5-year (pre-2011) or 10-year (post-2011) directed biogas contract requirement, they no longer procure directed biogas due to the high cost relative to natural gas.

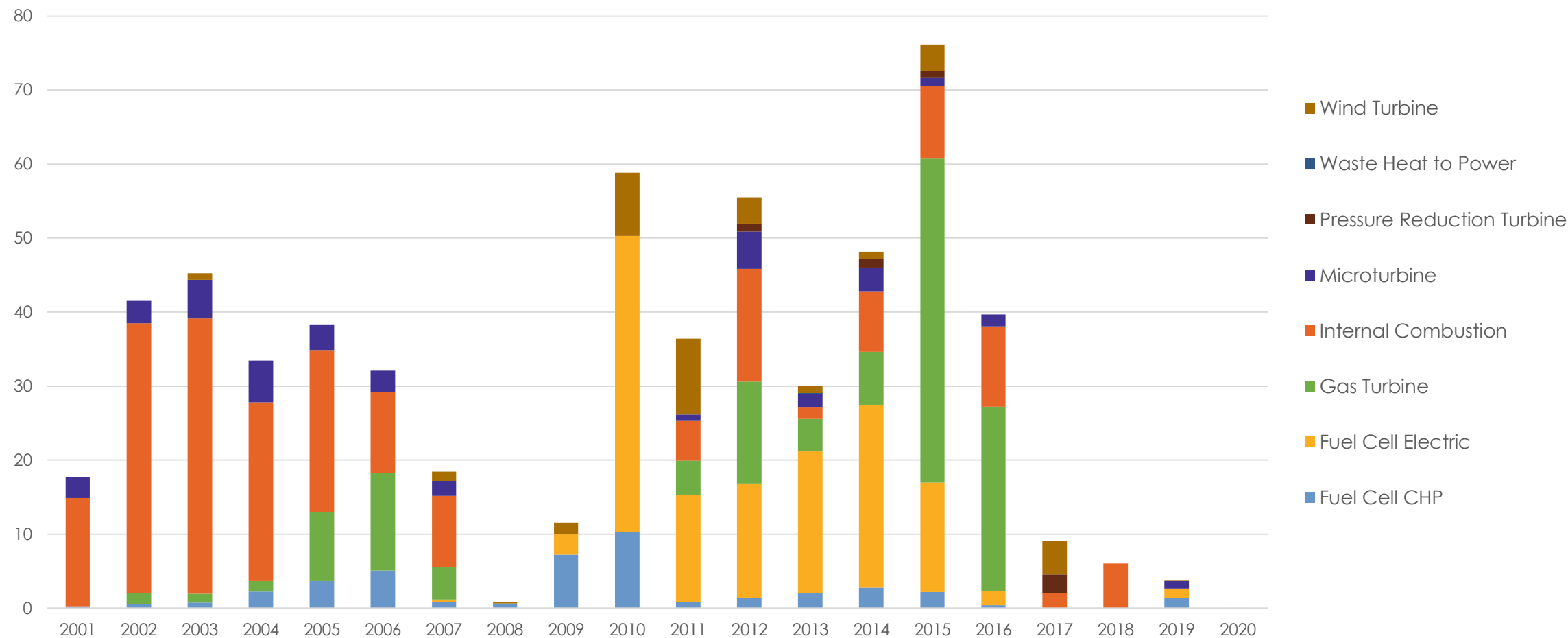


Source: Verdant Associates, November 2020

Number of Installed and Reserved Generation Projects in SGIP

Technology Type	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Fuel Cell CHP	1	1	2	3	6	7	2	6	18	63	2	7	2	2	2	1	0	0	1	0	126
Fuel Cell Electric	0	0	0	0	0	0	1	0	8	82	23	37	32	87	50	4	0	0	2	0	326
Gas Turbine	0	1	1	1	3	4	1	0	0	0	1	2	1	2	2	1	0	0	0	0	20
Internal Combustion	27	54	53	49	29	17	24	0	0	0	5	14	3	13	6	6	3	2	0	0	305
Microturbine	21	17	41	30	15	12	7	0	0	0	1	7	2	5	2	1	0	0	1	0	162
Pressure Reduction Turbine	0	0	0	0	0	0	0	0	0	0	0	2	0	4	3	0	1	0	0	0	10
Waste Heat to Power	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Wind Turbine	0	0	1	0	0	0	2	1	3	7	5	3	2	1	2	0	5	0	2	1	35
Total	49	73	98	83	53	40	37	7	29	152	37	72	43	114	67	13	9	2	6	1	985

Installed and Reserved Generation Projects in SGIP - MWs



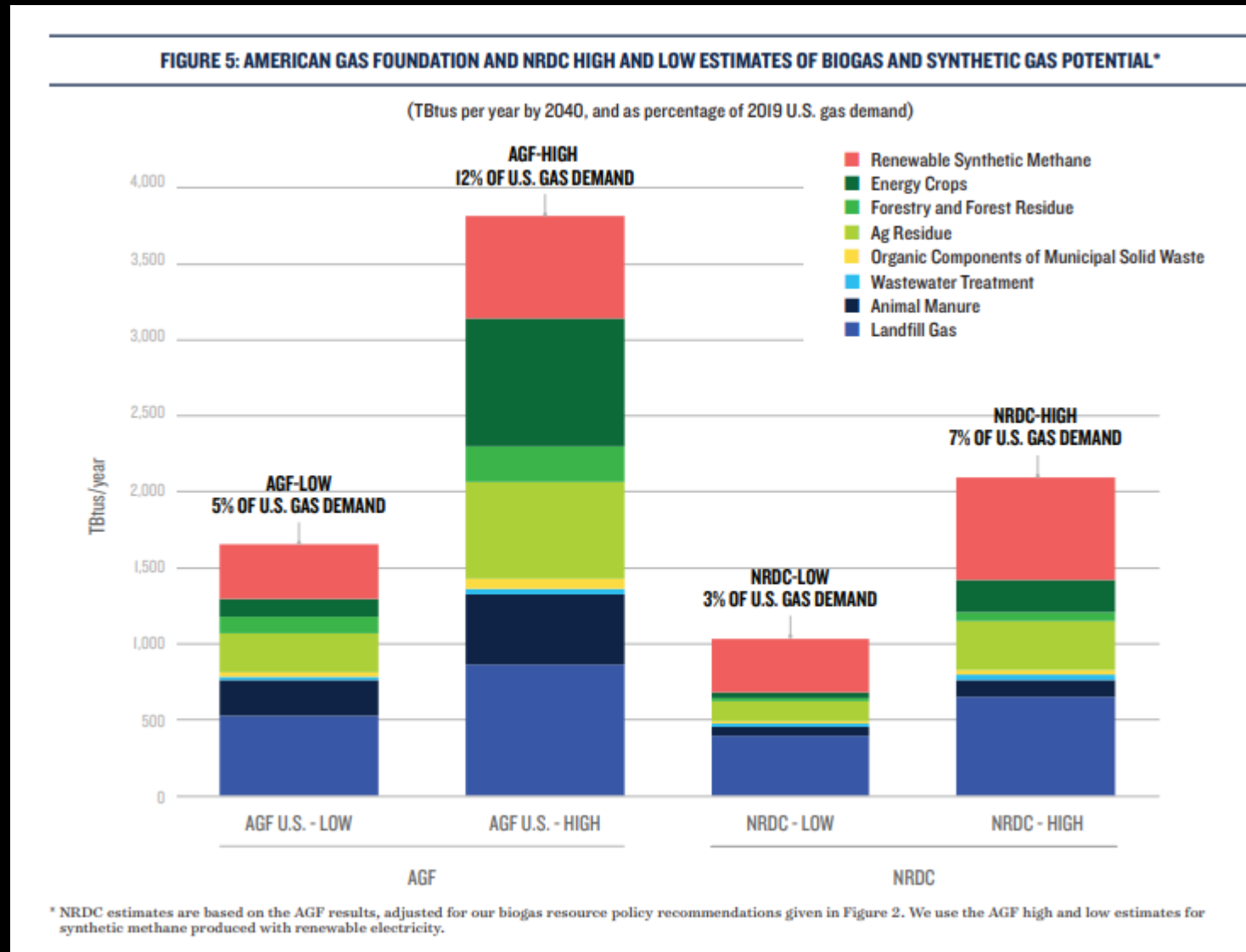


California Public Utilities Commission

Workshop on Self-Generation Incentive Program Renewable Generation

Sierra Club Concerns with Public Subsidy of
Directed Biogas Projects under SGIP

Biomethane Potential is a Small Fraction of Total Gas Demand



Source: NRDC, A Pipe Dream or Climate Solution: The Opportunities and Limits of Biogas and Synthetic Gas to Replace Fossil Gas

Use of Directed Biogas for Self-Generation is a Poor Use Case



CALIFORNIA
ENERGY COMMISSION

Energy Research and Development Division

FINAL PROJECT REPORT

The Challenge of Retail Gas in California's Low-Carbon Future

Renewable natural gas is found to be a valuable, but relatively expensive form of carbon reduction. Relatively low-cost biomass feedstocks are limited in quantity, so lower-cost PATHWAYS scenarios allocate these limited feedstocks to sectors that are difficult to electrify, like aviation, industry, and trucking. The limited supply of and competing uses for biofuels mean that scenarios that maintain high volumes of gas throughput in buildings require hydrogen and synthetic natural gas to reduce emissions.

Use of Directed Biogas for Self-Generation is a Poor Use Case

Any GHG Benefits are Rapidly Diminishing as Grid Decarbonizes

Benchmarking Greenhouse Gas Emissions for Delivered Electricity (Pounds of CO₂ per MWh)

U.S. Average ¹	947
Pacific Gas and Electric Company ²	
2018	206
2017	210
2016	294
2015	405
2014	435
2013	427
2012	445
2011	393
2010	445

Use of Directed Biogas for Self-Generation is a Poor Use Case

GHGs Will Increase When Projects Revert to Fossil Gas Use
Once Incentive Payments End

SELF-GENERATION INCENTIVE PROGRAM: RENEWABLE FUEL USE REPORT NO. 27

One final consideration regarding directed biogas projects is their limited term as renewable projects. SGIP rules require that directed biogas projects meet minimum renewable fuel use requirements for five years. After this five-year term, directed biogas projects are no longer required to procure directed biogas and can operate on non-renewable fuel. During this reporting period we find that most directed biogas projects have fulfilled their five-year terms and will likely continue operating on 100% natural gas.

Other Issues With Directed Biogas Projects Under SGIP

- No relationship between incentive level and carbon intensity of source fuel
- Lack of alignment with RPS standards allowing contracting with far away biomethane sources
- Lack of robust verification protocols
 - No onsite visits
 - A “concerning level of missing or inaccurate record” – RFUR Report
- Risks of double counting environmental benefits – still no tracking system despite 2016 decision



Fuel Cells at Wastewater Treatment Plants

How Renewable Gas Powered Fuel Cells Reduce Air and Methane Emissions

Paul Fukumoto
Director Business Development

November 14, 2020



Merits of Fuel Cells with Biogas

- **Effective conversion of anaerobic digester gas (ADG)**
 - *Multiple Sources available*
 - *Wastewater treatment, food or agricultural digesters*
 - *Avoids clean air permitting challenges*
 - *Additional GHG reduction benefits with CHP*
- **Multiple uses of power generated**
 - *Utilized On-Site*
 - *Delivered to Grid via BioMAT or other available Tariff*
- **Enhances site's energy resiliency with continuous supply of power**
 - *Not dependent on weather or time of day*
 - *Can be a core resource for a indefinite islanding during power outages*

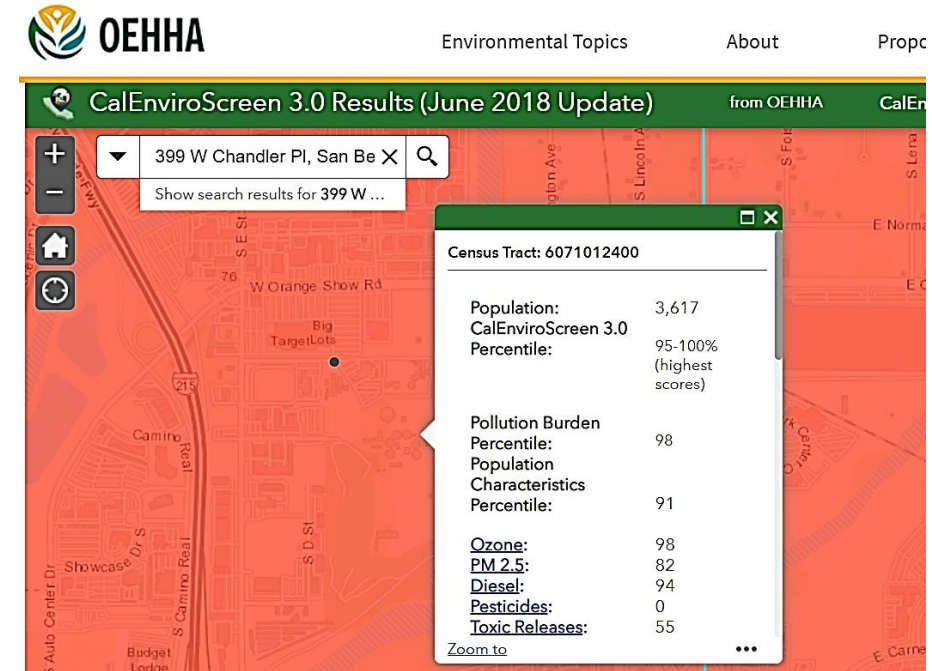


Resilient Clean Renewable Energy Resource for These Critical Facilities

Example: Fuel Cell for Compliance and CHP

City of San Bernardino, CA

- **Project with the City of San Bernardino Municipal Water Department (SBMWD)**
 - Compliance with SCAQMD requirement for alternative to gas engines
 - SBMWD receives electricity through a 20-year Power Purchase Agreement (PPA)
- **1.4 MW SureSource 1500™ Platform**
 - Operation on anaerobic digester gas and, as needed, natural gas
 - Electricity and thermal energy will support the SBMWD water reclamation plant (WRP)
 - Will utilize all WRP biogas; provide 65% of site power needs
- **Platform will use proprietary SureSource Treatment™ system**
 - Digester gas treatment
 - Fuel blending
 - Quality monitoring
- **Project under construction**

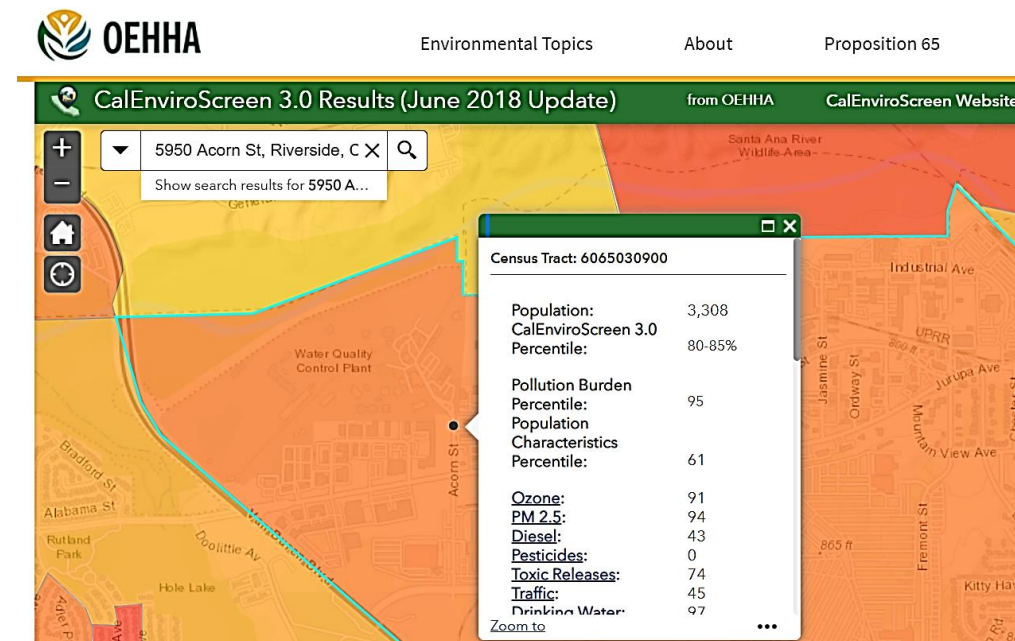


City decided to avoid flaring and use digester gas for onsite energy

Example: On-Site Biogas to CHP

City of Riverside, CA

- **Project at City of Riverside Water Quality Control Plant (WQCP)**
- **1.4 MW SureSource 1500™ Platform**
 - In Service in 2016
 - 20-year Power Purchase Agreement (PPA)
 - No capital expense up front
 - Proprietary SureSource Treatment™ system
 - Complete turn-key solution
- **Generates carbon-neutral power and heat for anaerobic digesters**
 - Uses two thirds of the WQCP biogas
 - Provides one third of WQCP facility's total power needs



City decided to avoid flaring and use digester gas for onsite energy

Example: Biogas Fuel Purchase

City of Tulare, CA

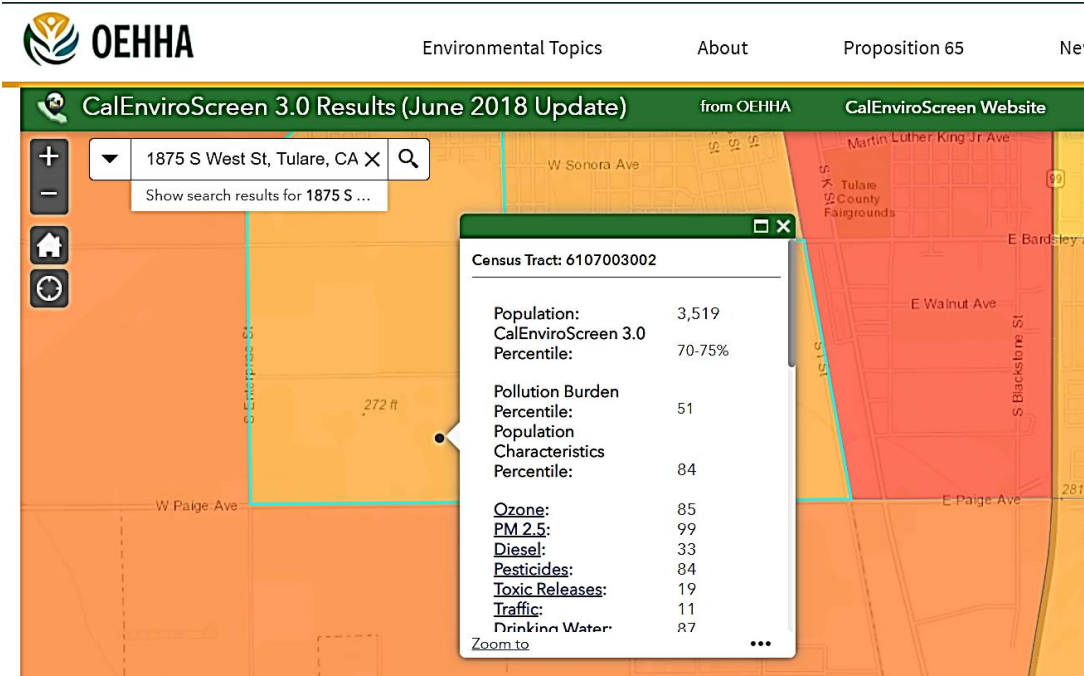
Project at City of Tulare Wastewater Treatment Facility (WWTF)

Digester gas purchase agreement and site lease

- Biogas supply from WWTF & backup directed biogas
- 2.8 MW SureSource 3000™ fuel cell platform
- Largest facility under the California Bioenergy Market Adjustment Tariff (BioMAT).
- 20-year BioMAT PPA provides renewable and carbon neutral power to the SCE grid.

City of Tulare benefits from biogas revenue

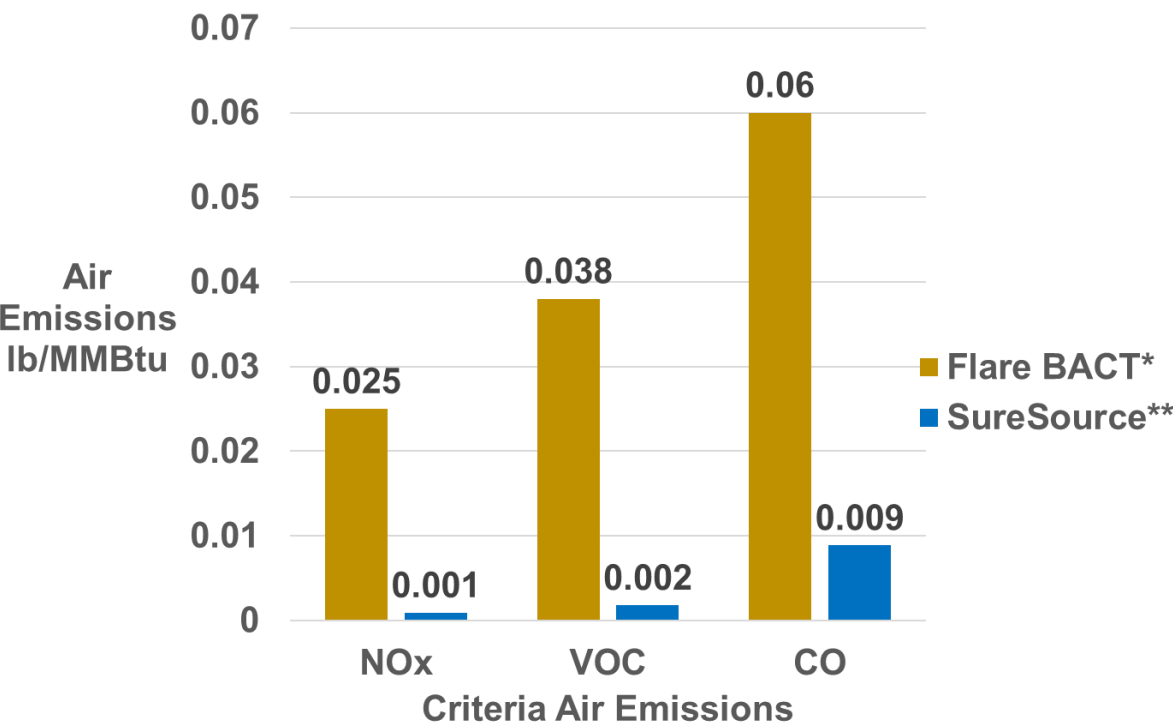
- Allows focus on core activity of WWTF operation



City decided to avoid flaring and use digester gas for revenue source

Significant Reduction of Air Pollution with SureSource Platform

Criteria Air Emissions Comparison
Flare BACT and SureSource Fuel Cell Platform



*SCAQMD Rule 1118.1 (adopted January 2019)
**SureSource Platform is CARB DG Certified for Biogas (DG-046 & DG-048)

Estimated Resulting Air Emissions Benefits

	SureSource 1500 Emissions Reductions lb/yr	SureSource 3000 Emissions Reductions lb/yr
NOx Avoided	2,147	4,294
VOC Avoided	3,226	6,452
CO Avoided	4,554	9,109

SureSource Platform gives these facilities in Disadvantaged Communities long term savings/revenues while reducing the air pollution burden

Flaring Methane Emissions Using EPA AP-42 Emissions Factors

- Properly operated flares achieve at least 98% percent combustion efficiency in the flare plume, meaning that hydrocarbon and CO emissions amount to less than 2 percent of hydrocarbons in the gas stream

Table 13.5-1 (English Units). EMISSION FACTORS FOR FLARE OPERATIONS^a

EMISSION FACTOR RATING: B

Component	Emission Factor (lb/10 ⁶ Btu)
Total hydrocarbons ^b	0.14
Carbon monoxide	0.37
Nitrogen oxides	0.068
Soot ^c	0 - 274

^a Reference 1. Based on tests using crude propylene containing 80% propylene and 20% propane.

^b Measured as methane equivalent.

^c Soot in concentration values: nonsmoking flares, 0 micrograms per liter (µg/L); lightly smoking flares, 40 µg/L; average smoking flares, 177 µg/L; and heavily smoking flares, 274 µg/L.

<https://www3.epa.gov/ttnchie1/ap42/ch13/final/c13s05.pdf>

Flare Hydrocarbon Emissions as CH₄ with EPA EF

Biogas Flow MMBtu/hr	Flaring CH ₄ Equivalent Emissions lb/hr	Flaring CO ₂ _e mT/yr using 20 year GWP factor of 84 for CH ₄ as SLCP
11.3 ¹	1.58	475
22.6 ²	3.12	938

<https://www.epa.gov/ghgemissions/understanding-global-warming-potentials#Learn%20why>

¹ Equivalent biogas usage by FCE SureSource 1500 (1.4 MW)

² Equivalent biogas usage by FCE SureSource 3000 (2.8 MW)

Avoiding Flaring Reduces Methane Pollution from Combustion Inefficiency

Using Otherwise Flared Biogas in Fuel Cells Supports 24/7 Critical Facility Infrastructure

Waste and Organics from Everyday Life are the Sources of Biogas



Local Communities Benefit Environmentally and Financially by Using Biogas in Fuel Cells

fuelcellenergy

FuelCell Energy: A Global Leader in Fuel Cell Technology – Operating Since 1969

COMPANY OVERVIEW

- Deliver clean and affordable fuel cell solutions for the supply, recovery and storage of energy
- SureSource fuel cell systems provide continuous baseload power and are deployed with utility, municipality, university and industrial and commercial enterprise customers
- Turn-key solutions from design and installation of a project to long-term operation and maintenance of fuel cell system

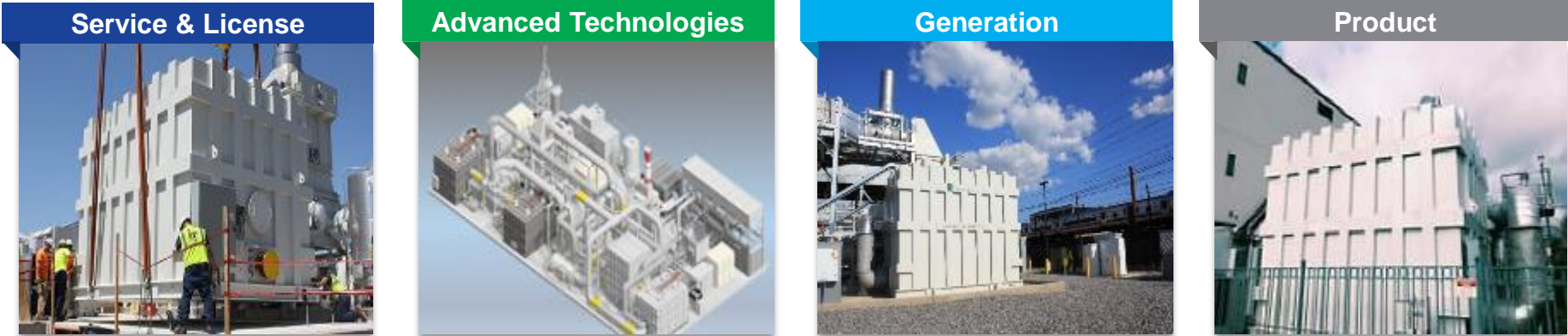
COMPANY HIGHLIGHTS¹

Headquarters	Danbury, CT
Listing: NASDAQ	FCEL
Employees	~300
Continents	3
Global Plant Installations	59
Capacity in Field	>260 MW

GLOBAL CUSTOMERS



Over 10 Million MWh generated by SureSource™ plants around the world



 **Enable The World To Live A Life Empowered By Clean Energy** 

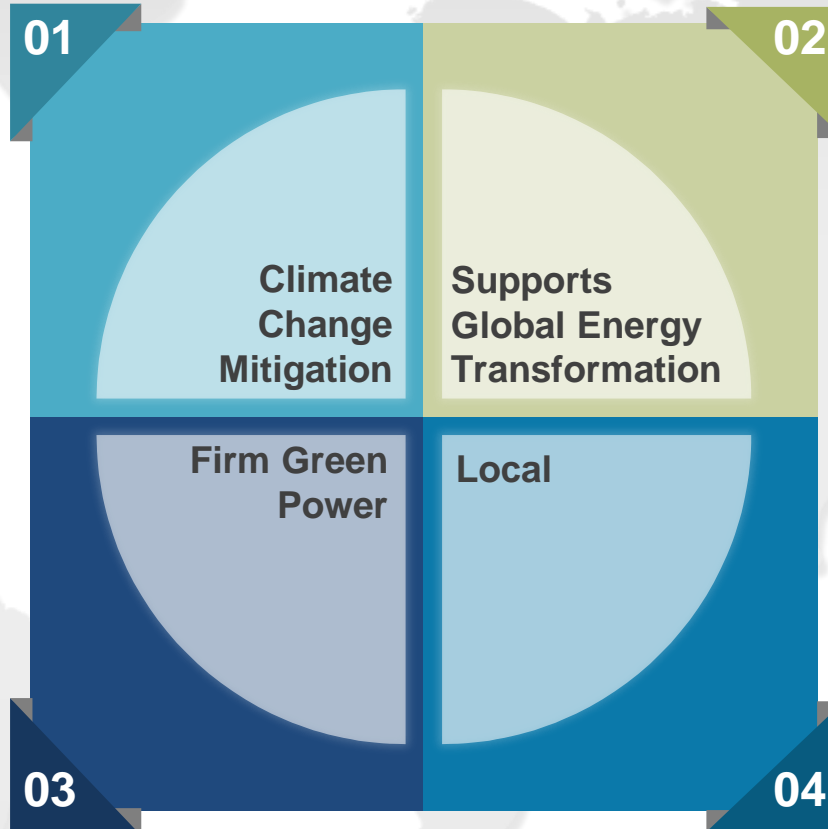
FuelCell Energy Technology: Addressing The 4 Major Energy Opportunities

Carbon Capture

- ❑ Most efficient Carbon Capture technology – Produces MW while capturing carbon
- ❑ Increases output of host plant, providing additional generation / ancillary revenue
- ❑ Power revenue stream reduces cost of CO₂ capture

Electrolysis Hydrogen Energy Storage Hydrogen Power Generation

- ❑ ≥ 8hr Energy Storage “Virtual-Battery”
- ❑ > 100% electrical efficiency when utilizing excess thermal energy
- ❑ Fully scalable energy storage (caverns, etc.)
- ❑ Provides efficient, dispatchable, zero emissions power while **avoiding the raw material and disposal issues of batteries**



Distributed Hydrogen

- ❑ Hydrogen production at the point of need – Avoid emissions & cost of transport
- ❑ Hydrogen co-produced with power and thermal energy
- ❑ Low carbon footprint with natural gas
- ❑ Zero carbon footprint with biogas
- ❑ Carbon (-) with H₂ tradeoff of Nat Gas
- ❑ No water consumption

Distributed Generation

- ❑ Multi-Fuel
- ❑ Microgrid
- ❑ CHP
- ❑ Carbon Capture and Separation
- ❑ Sub-MW through Large MW Scale
- ❑ Grid Resiliency | Reliability
- ❑ Limited Space Requirements
- ❑ Avoid transmission upgrade and infrastructure costs

Climate Priorities:

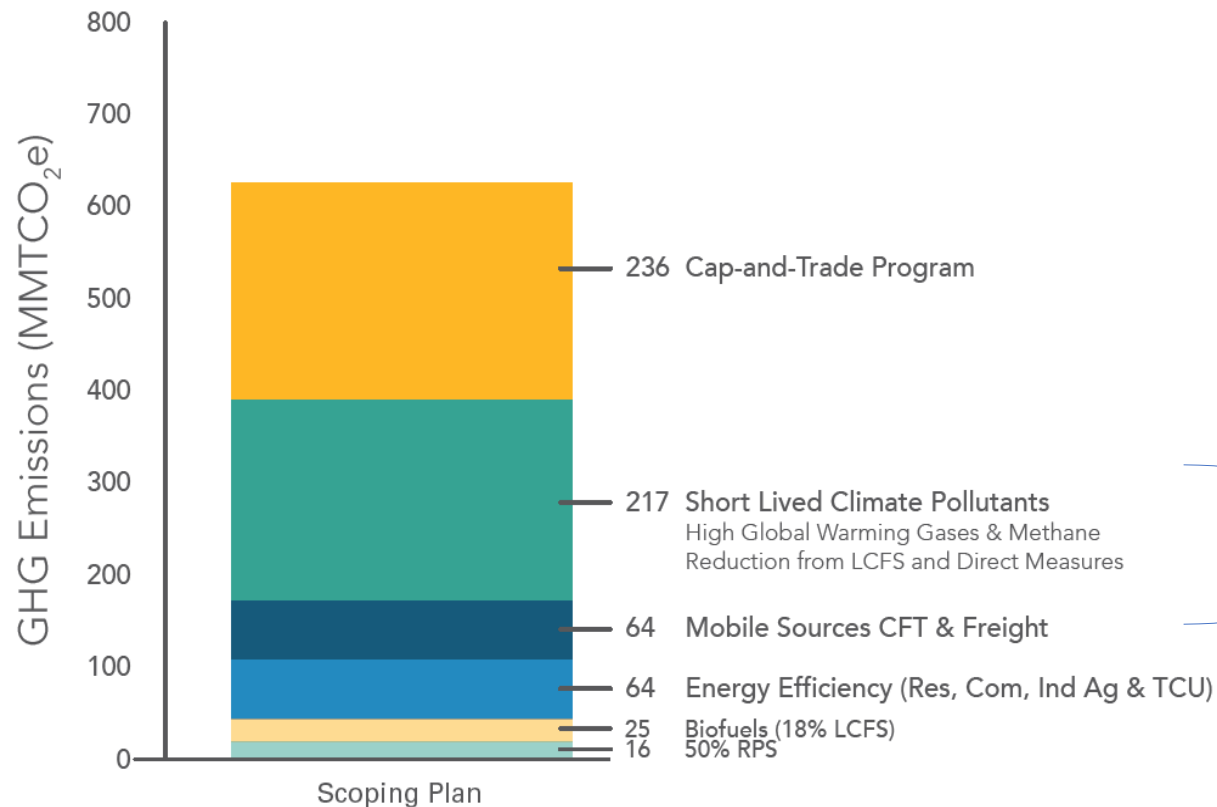
IPCC: We have 12 years left to reduce climate pollution or face catastrophic changes

ARB: SLCP Reduction and carbon sequestration are the only ways to immediately reverse climate change and its impacts

SLCP's are tens to thousands of times more damaging to the climate than CO₂

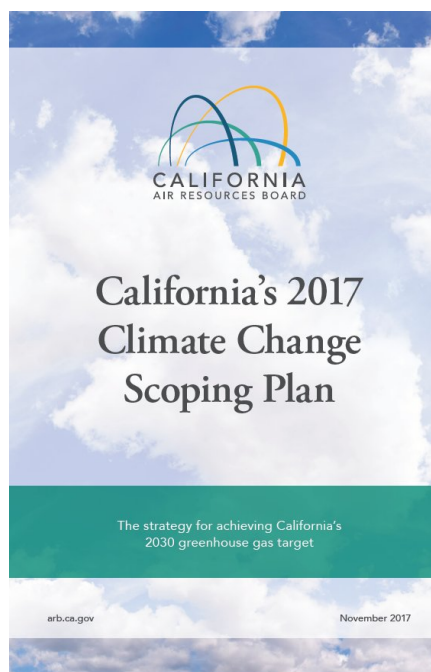
SLCP Reductions in California's Climate Plan

FIGURE 7: SCOPING PLAN SCENARIO – ESTIMATED CUMULATIVE GHG REDUCTIONS BY MEASURE (2021–2030)⁶⁴



**More than one-third
of CA's Climate
Strategy Depends on
SLCP Reductions**

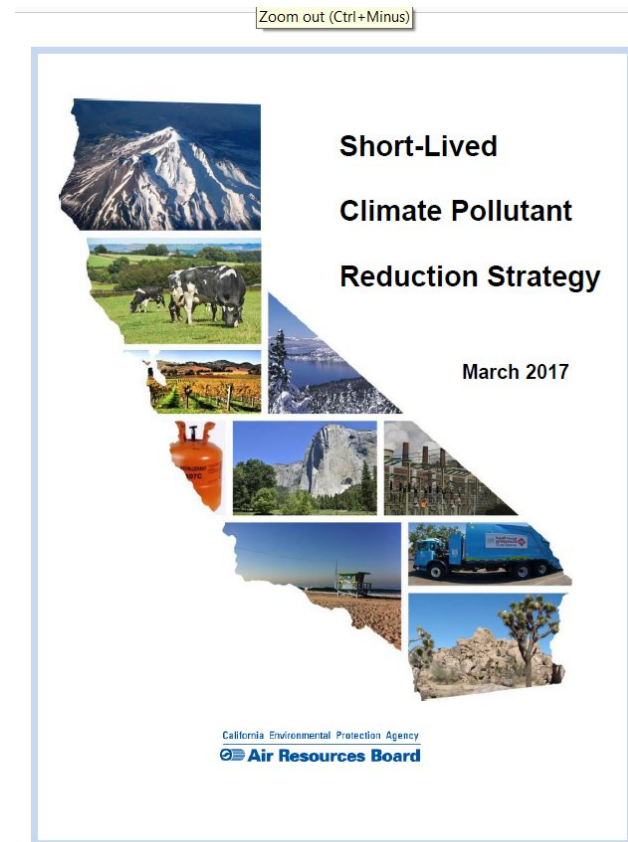
California's Climate Change Scoping Plan



- “Organic matter can provide a clean, renewable energy source in the form of bioenergy, biofuels, or renewable natural gas.”
- Need to increase production of renewable transportation fuels and energy from organic waste
- Need to remove barriers to pipeline biogas and electricity interconnection

CA's Short-Lived Climate Pollutant Strategy

- The State's organic waste should be put to beneficial use for electricity generation, transportation fuel, and pipeline biogas
- Building organic waste to energy facilities and infrastructure would lead to billions of dollars of investment and thousands of jobs in the State



California's Technically Available Organic Waste Feedstocks

Feedstock	Amount Technically Available	Billion Cubic Feet Methane	Million Gasoline Gallon Equivalents
Landfill Gas	106 BCF	53	457
Animal Manure	3.4 M BDT	19.5	168
Waste Water Treatment Gas	11.8 BCF	7.7	66
Fats, Oils and Greases	207,000 tons	1.9	16
Municipal Solid Waste (food, leaves, grass)	1.2 M BDT	12.7	109
Municipal Solid Waste lignocellulosic fraction)	6.7 BDT	65.9	568
Agricultural Residue (Lignocellulosic)	5.3 M BDT	51.8	446
Forest, Sawmill, Shrub & Chaparral Residues	26.2 M BDT	256	2,214
BIOGAS POTENTIAL		468.5	4,044

Sources: Rob Williams and Stephen Kaffka, UC Davis, presentation to the California Energy Commission on January 30, 2017;
Lawrence Livermore National Lab assessment of forest, sawmill, shrub & chaparral residues

Biogas can Provide Locally Sourced, Carbon Negative Generation and Storage



Carbon Intensity of Fuels (grams CO₂e / MJ)

Diesel	102
Gasoline	100
Corn ethanol	34-75
Natural Gas	68
Fuel Cell (non-renewable hydrogen)	39
Electric vehicles (CA power grid)	31
Biodiesel	9 to 50
Landfill Biogas	11 to 40
Biogas from forest waste	14
Wastewater Biogas (large facilities)	8 - 30
Biogas from Diverted Food and Green Waste	-15 to -100
Dairy Biogas	- 276 to -330

www.arb.ca.gov/fuels/lcfs/lcfs.htm



GETTING TO NEUTRAL

OPTIONS FOR NEGATIVE
CARBON EMISSIONS IN
CALIFORNIA

THE **CARBON**
INITIATIVE

California Negative Emissions

LLNL-PRES-795982

How can California achieve 125 MT/year of negative emissions by mid-century?

Natural and

Working Lands



25 MT/year

■ Waste Biomass Conversion to Fuels with CO₂ Storage



83 MT/year

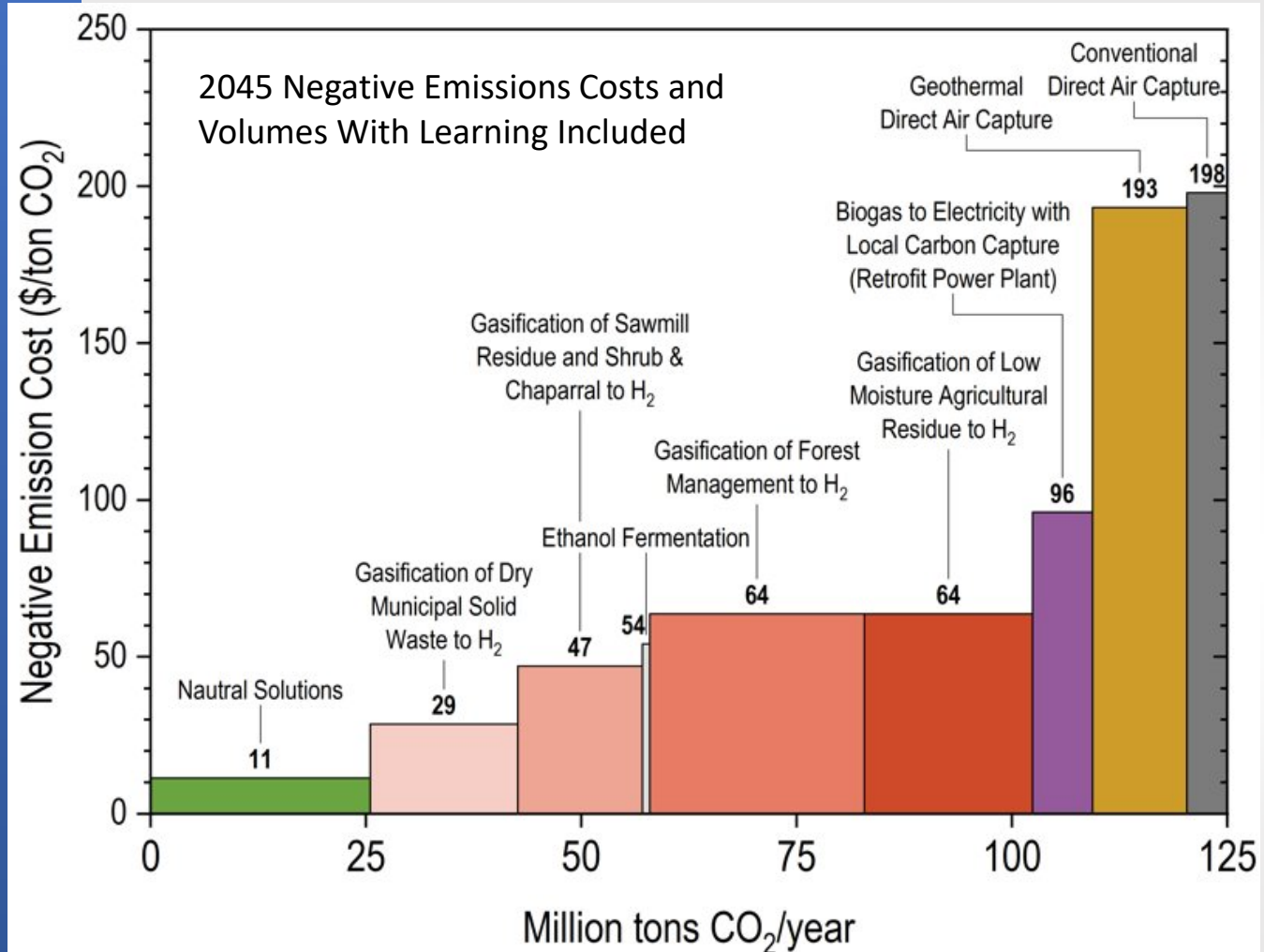
■ Direct Air Capture with CO₂ Storage



17 MT/year

Technological readiness: mid-to-high – no new breakthroughs required

The least-cost path to 125 MT/year uses natural solutions, gasification of biomass to H₂, and some direct air capture.



University of California

- UC has set biomethane procurement goal to meet the UC's carbon neutrality goal
- Recent procurement agreement with landfill in San Bernardino County to supply enough biomethane to meet all of UCSB's gas needs
- Biomethane fuels existing UC power plants, provides CHP and renewable hydrogen
- Keeps essential services operating, including UC hospitals and labs



Miramar Marine Corps Air Station

- 20 MW microgrid in San Diego County
- Includes 3.2 MW of landfill gas powered flexible generation
- The microgrid uses solar energy and biomethane to keep mission-critical buildings operational during power shut-offs.



Altamont Pass Landfill

- CEC helped fund landfill gas to energy project
- Landfill produces enough biogas to generate 6 MW of RPS power and 13,000 gge/day of vehicle fuel that has replaced diesel in WM garbage trucks
- GHG and NOx reductions compared to flaring the landfill gas



Why Landfill and Wastewater Biogas?

- Landfills and WWTF are essential services that protect public health
- They produce biogas whether it's used or not
- Using for power generation reduces NO_x, PM and carbon emissions compared to flaring
- California wastes \approx 250 million gge worth of landfill gas / year



Recommendations for SGIP

Directed biogas should be allowed provided it meets requirements of PU Code 399.12.6

Carbon negative fuels should receive additional incentives, but other GHG tests should not be required unless required for all SGIP sources

Carbon intensity should be based on lifecycle emissions, including avoided emissions, using the GREET model

Tracking should be consistent with BioMAT and other distributed generation programs

Green hydrogen needs to include H₂ from biogas

THANK YOU

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Bioenergy
Association of
California

Fuel Cells for Resilience and Decarbonization in California

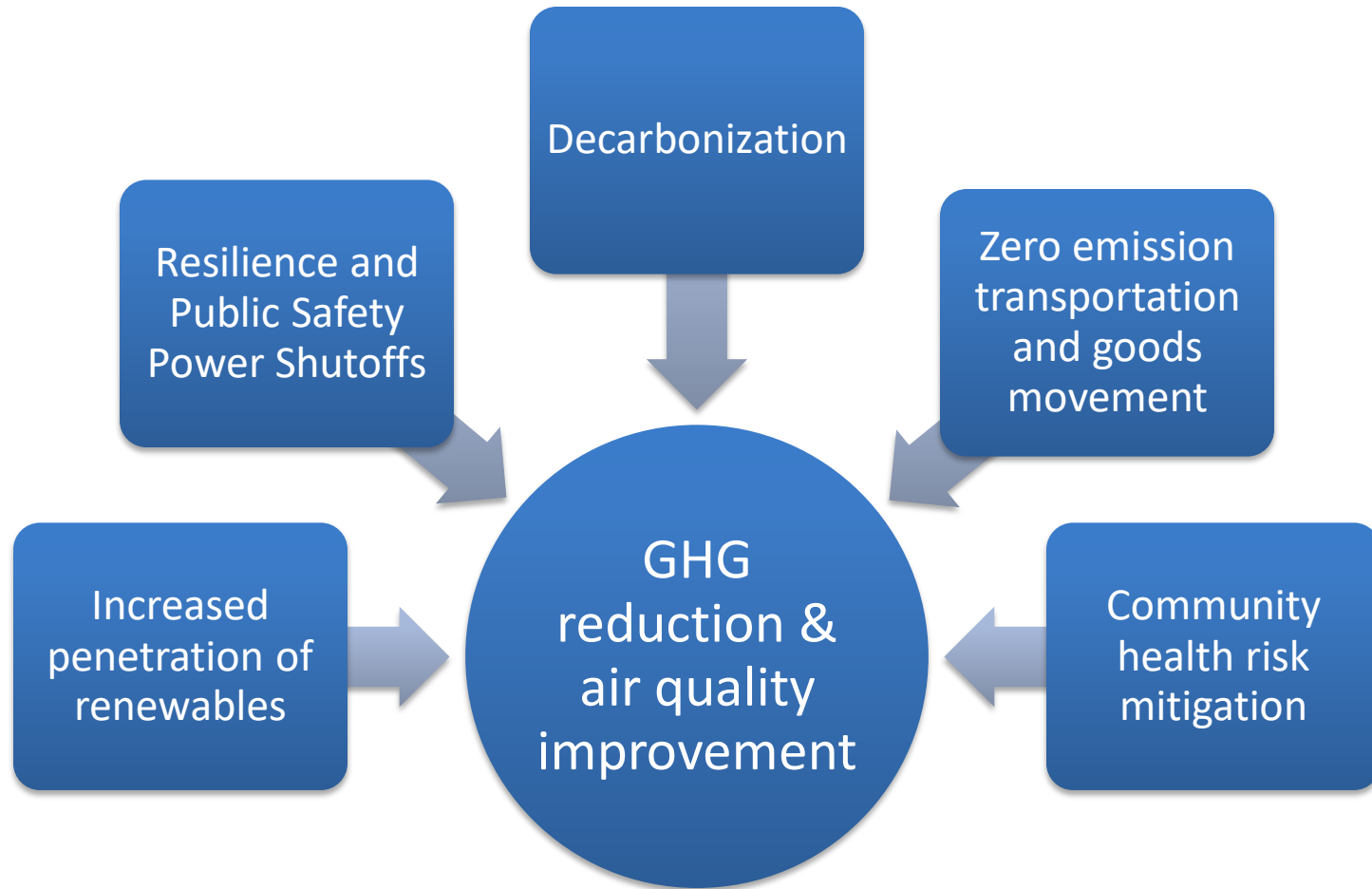
November 12, 2020



**California Stationary
Fuel Cell Collaborative**



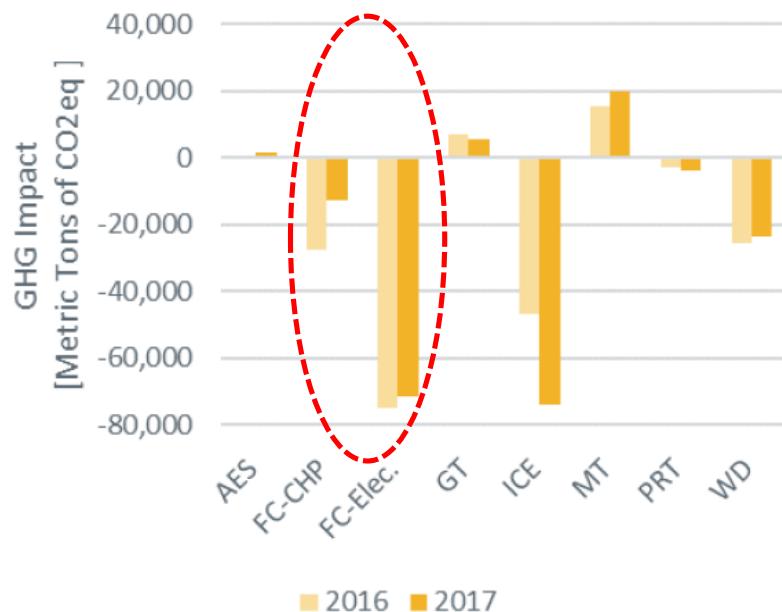
California Policy Priorities



Fuel Cell Emissions Reduction Quantified

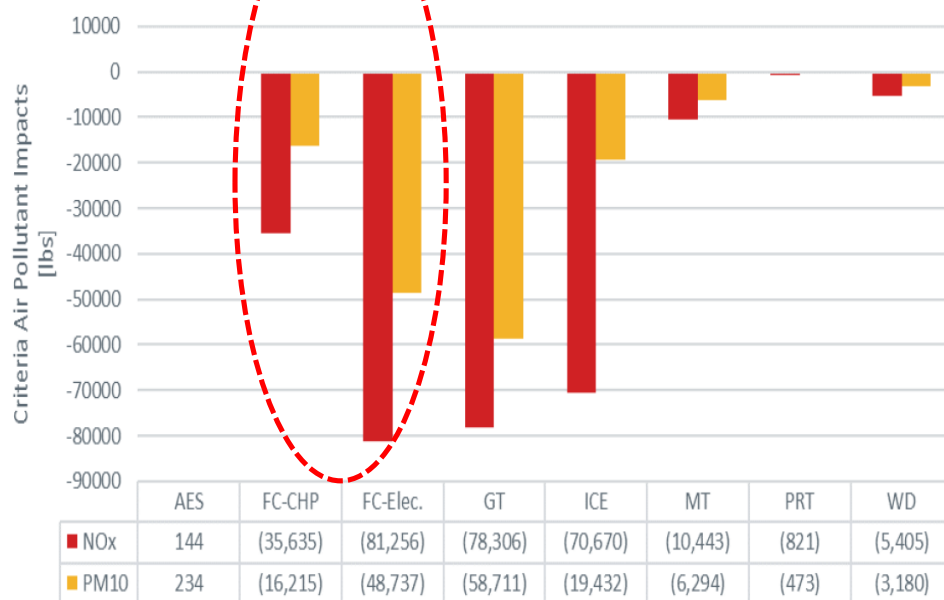
GHG Reductions

By Technology Type and Year (A)



Criteria Air Pollution Reductions

FIGURE ES-4: CRITERIA AIR POLLUTANT IMPACTS BY TECHNOLOGY TYPE (2017)



Source: SGIP 2016-2017 Impact Report, Table ES-6: GHG Impacts by Technology Type and Year and Figure ES-4 Criteria Air Pollutant Impacts By Technology Type (2017)

Stationary Fuel Cells in Microgrids

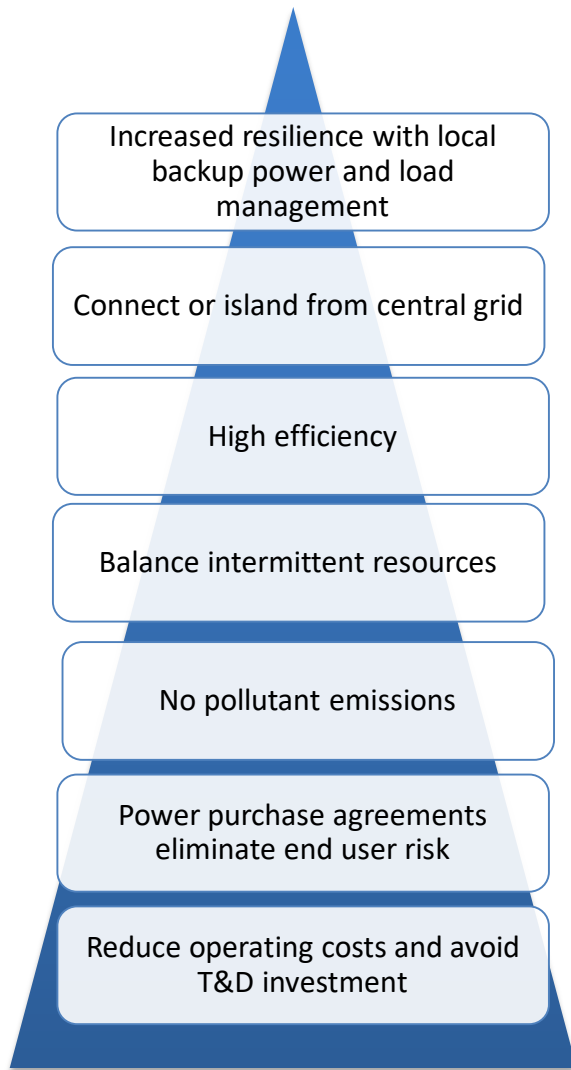


Photo courtesy of FuelCell Energy

Demonstrated Resilience of Fuel Cells and Gas System

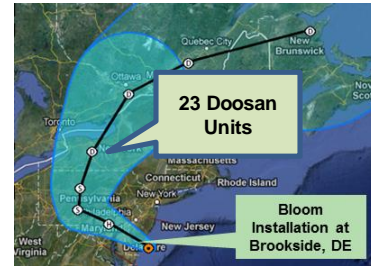
San Diego Blackout, 9/28/11



Winter Storm Alfred, 10/29/11



Hurricane Sandy, 10/29/12



CA Earthquake, 8/24/14



Data Center Utility Outage, 4/16/15



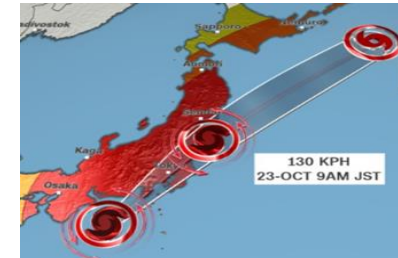
Hurricane Joaquin, 10/15/15



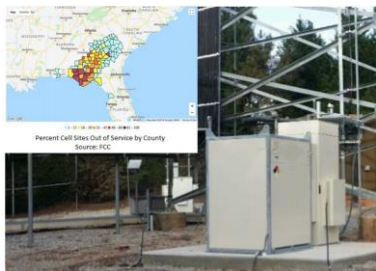
Napa Fire, 10/9/17



Japanese Super-Typhoon, 10/23/17



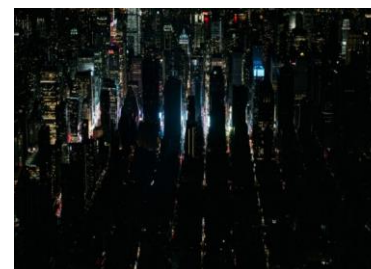
Hurricane Michael, 10/15/18



Ridgecrest Earthquakes, 7/4-5/19



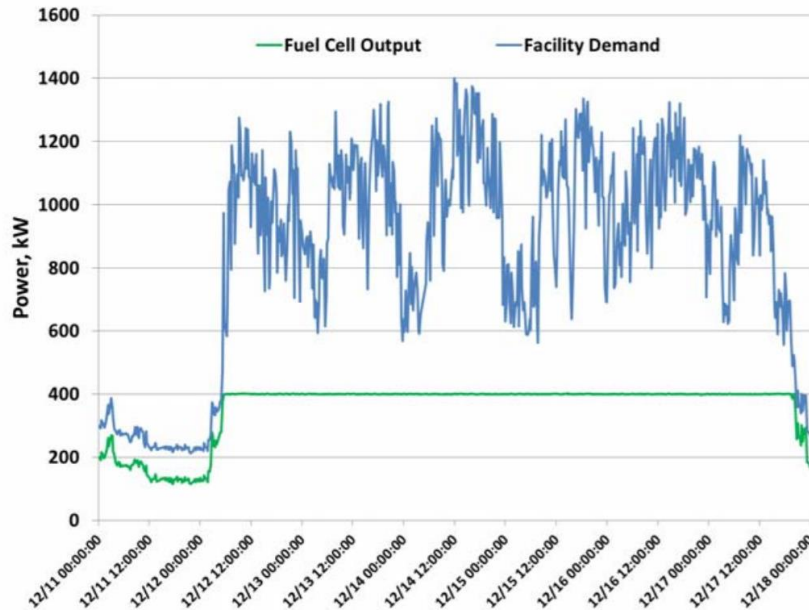
Manhattan Blackout, 7/13/19



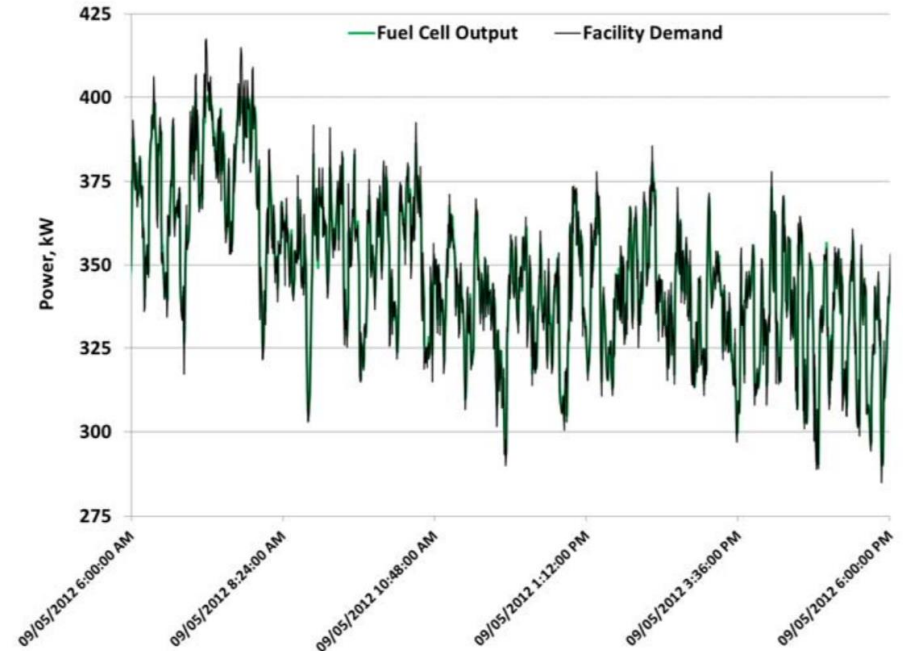
**> 99.999%
reliability**

Gas Technology Institute, Assessment of Natural Gas ... Service Reliability, 2018.

Fuel Cells for Dispatchable Load Following



- Coca-Cola bottling facility
- 5 day/week production facility
- 400 kW baseload weekdays
- Load-following with 100 kW minimum utility import on weekends



- Whole Foods Market
- Supermarket
- Continuous load-following
- Net-metering with zero utility power import

Fuel Cell use of Biogas is Better than Alternatives

- Beneficial use (power/heat) is always better than flaring
- Fuel cell use of biogas in SGIP reduces GHG
- Fuel cell use in SGIP eliminates pollutant emissions, esp. compared to the diesel/peaker alternatives
- Fuel cell GHG assessment in SGIP should be equally/fairly applied to all technologies in the program
- Fuel cell use in SGIP helps with PSPS and wildfire challenges
- Since biogas is scarce, CPUC should adopt the broadest definition(s) possible
- Electrolytic and biogenic hydrogen should be eligible in SGIP

Fuel Cells for Resilience and Decarbonization in California

November 12, 2020



**California Stationary
Fuel Cell Collaborative**

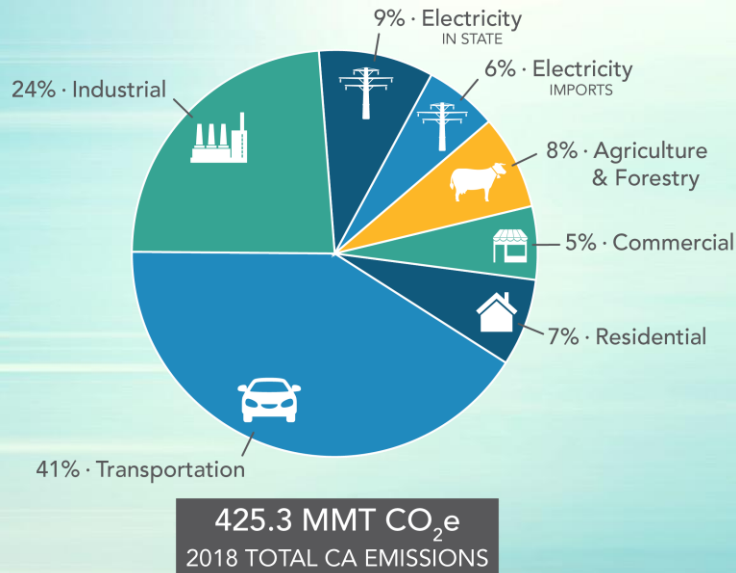




Low Carbon Fuel Standard: Overview

Low Carbon Fuel Standard (LCFS)

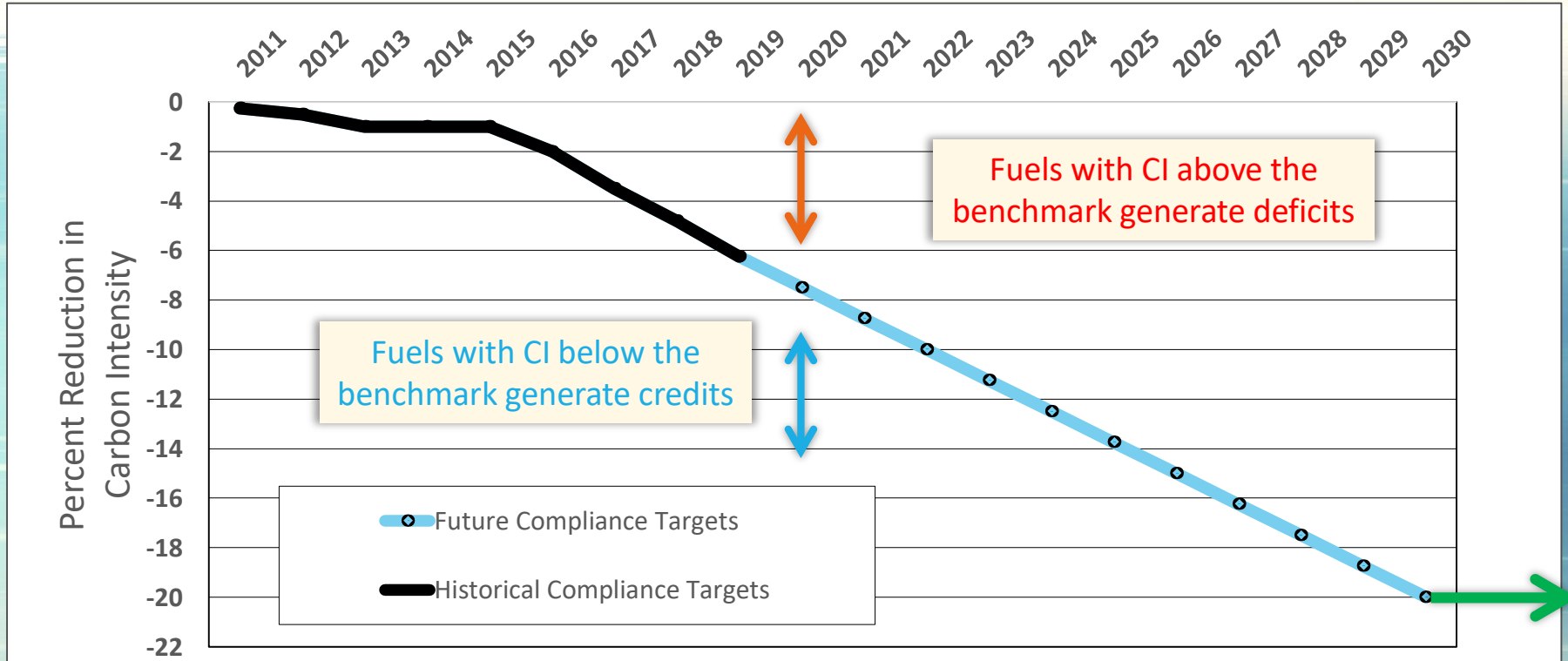
California's primary program to promote alternative fuel use in the transportation sector



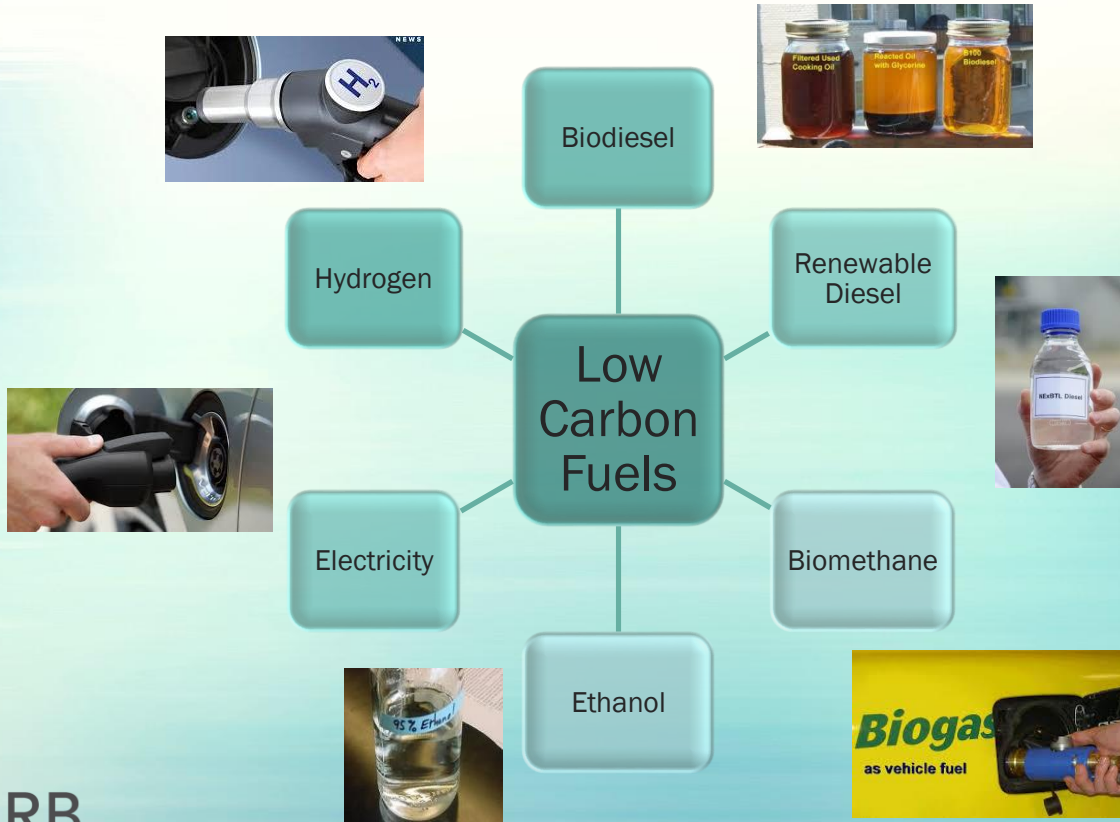
- Reduce carbon intensity of transportation fuels
- Transform and diversify fuel pool
- Reduce petroleum dependency
- Reduce emissions of criteria pollutants and toxics

Transportation sector accounts for 50% of State's GHG inventory when industrial emissions from refining and oil production are included

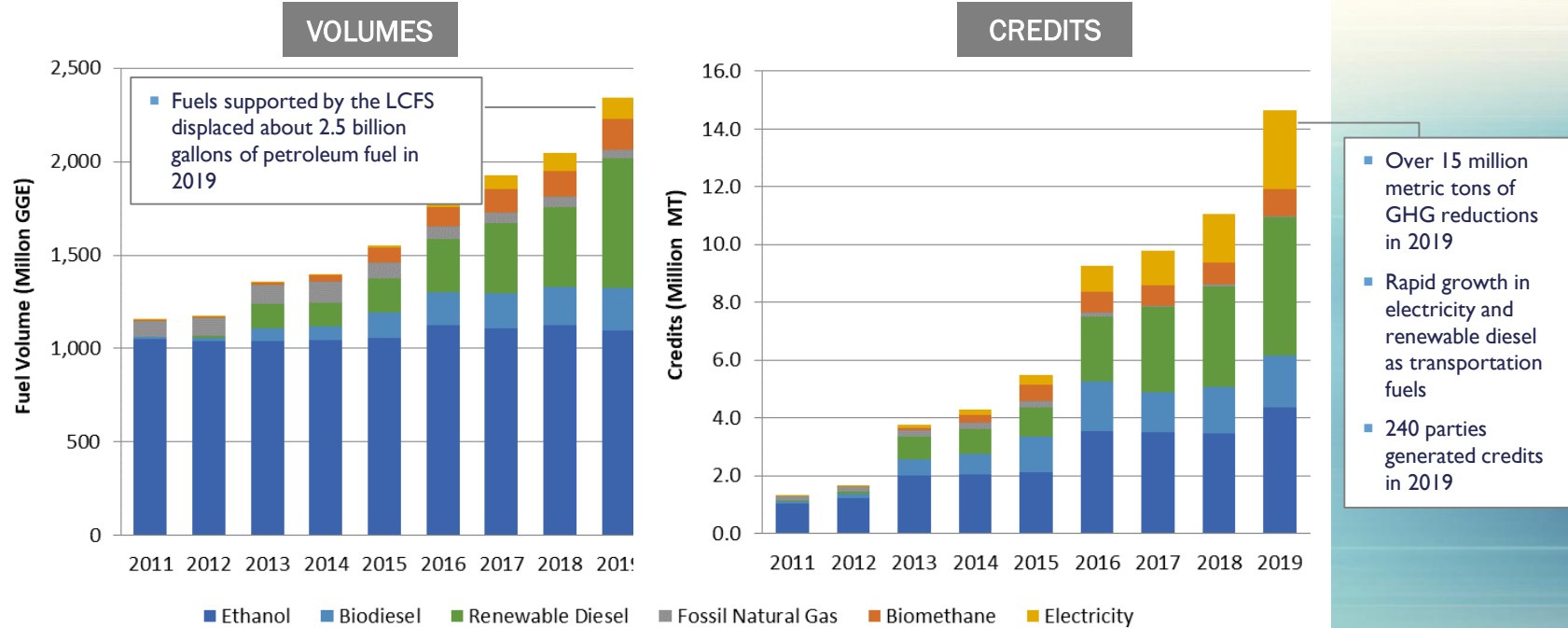
How Does LCFS Work?



Most Common Low Carbon Fuels



Diverse and Growing Alternative Fuel Pool

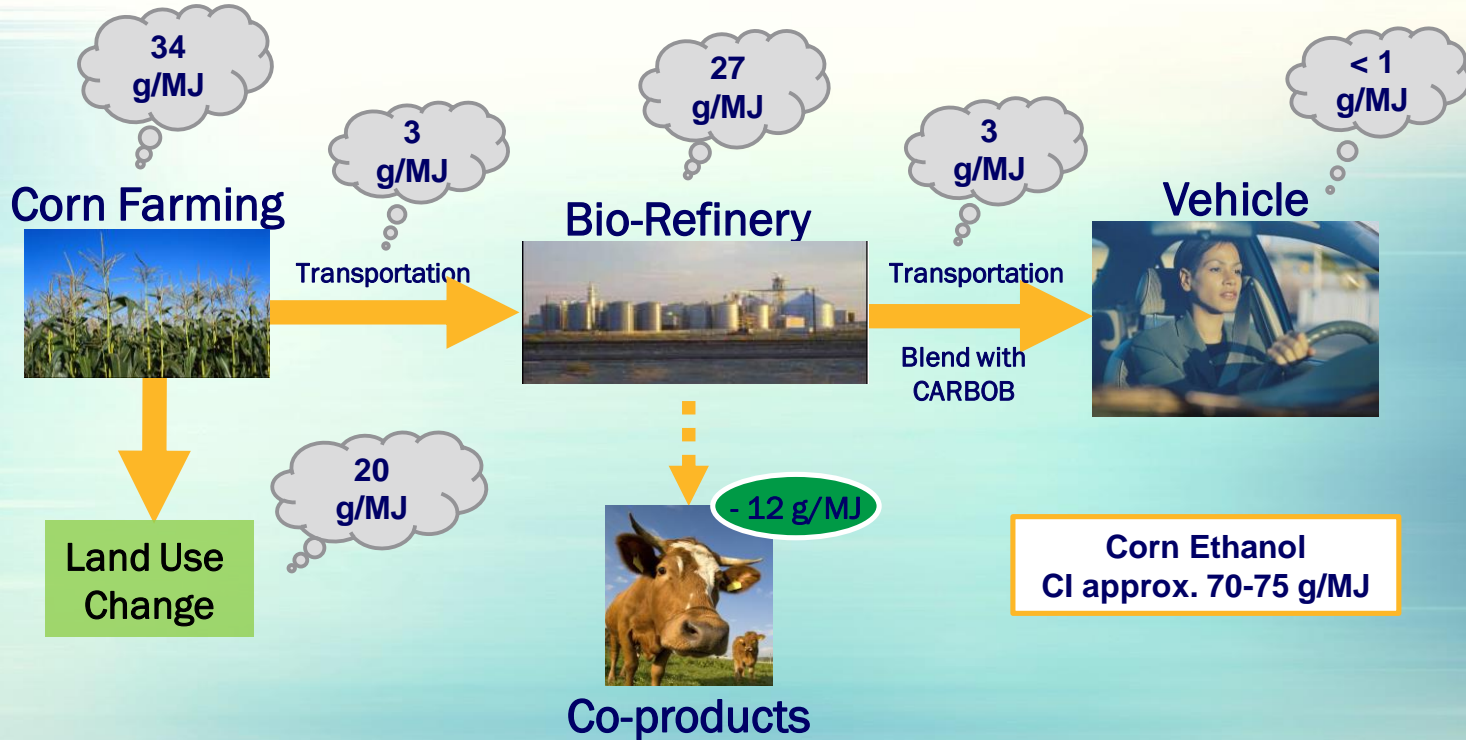


“Well-to-Wheel” Life Cycle Analysis

- CI includes the “direct” effects of producing and using the fuel, as well as “indirect” effects that are primarily associated with crop-based biofuels
- Modeling tools:
 - California Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (CA-GREET): Direct carbon intensity of fuel production and use
 - Oil Production Greenhouse Gas Emissions Estimator (OPGEE): Direct carbon intensity of crude production and transport to the refinery
 - Global Trade Analysis Project (GTAP) + Agro-Ecological Zone Emissions Factor (AEZ-EF) model: Used to estimate indirect effects associated with crop-based biofuels

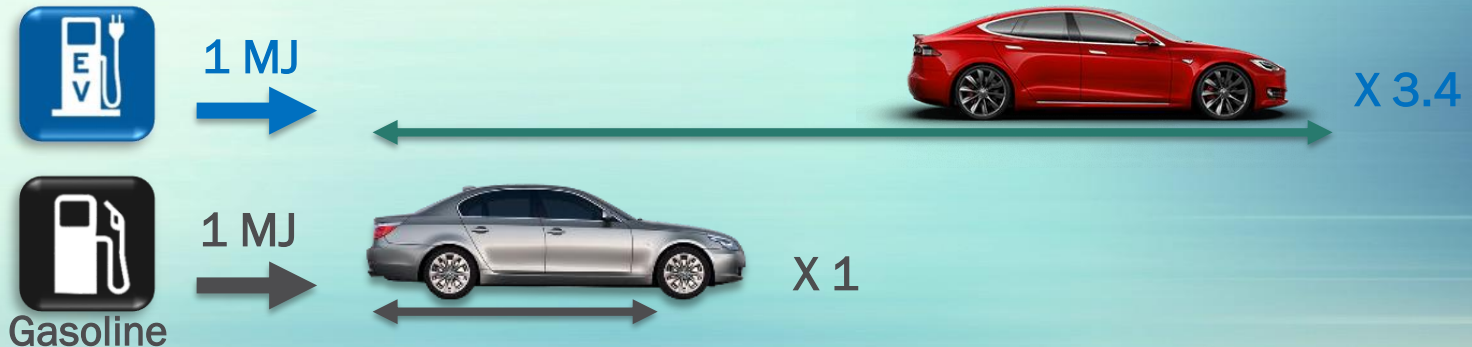


LCA Example: Corn Ethanol



Energy Economy Ratio (EER)

- Energy Economy Ratio represents the efficiency of fuel use in alternative fuel vehicle compared to that of conventional vehicle (tank-to-wheel portion of life cycle)
- In simple terms, it compares the useful “output” derived from a unit of energy of alternative fuel vs. conventional baseline fuel in same application
- For example, EER for battery electric light duty vehicle in comparison to gasoline powered internal combustion engine car is 3.4. This means, 1 MJ of energy will drive electric car 3.4 times more than gasoline car

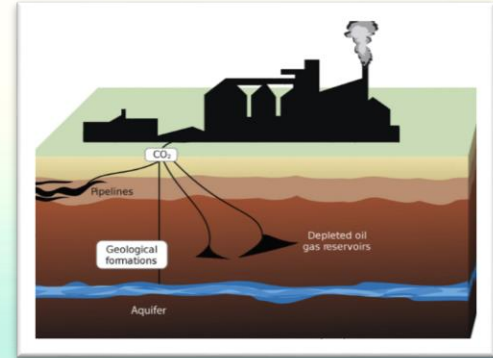


Reporting, Credit Generation and Verification

- Approved entities report fuel quantities sold in California to our Low Carbon Reporting Tool (LRT) on a quarterly basis
- Credits generated for fuel transactions in previous quarter based on the carbon intensity and quantity of the fuel reported and the end-use vehicle application
- Beginning in 2020, implementation of mandatory annual verification of operational data and fuel transactions reporting

Other Crediting Opportunities

- Project-based crediting:
 - Innovative crude production projects
 - Refinery-focused projects
- Carbon Capture and Sequestration (CCS)
 - Can be paired with crude oil production, refinery processing and biorefineries, or as a stand-alone direct air capture project
- Alternative Jet Fuel
- Zero Emission Vehicle Refueling Infrastructure
- Off-road electric transportation





THANK YOU

CALIFORNIA PUBLIC UTILITIES COMMISSION

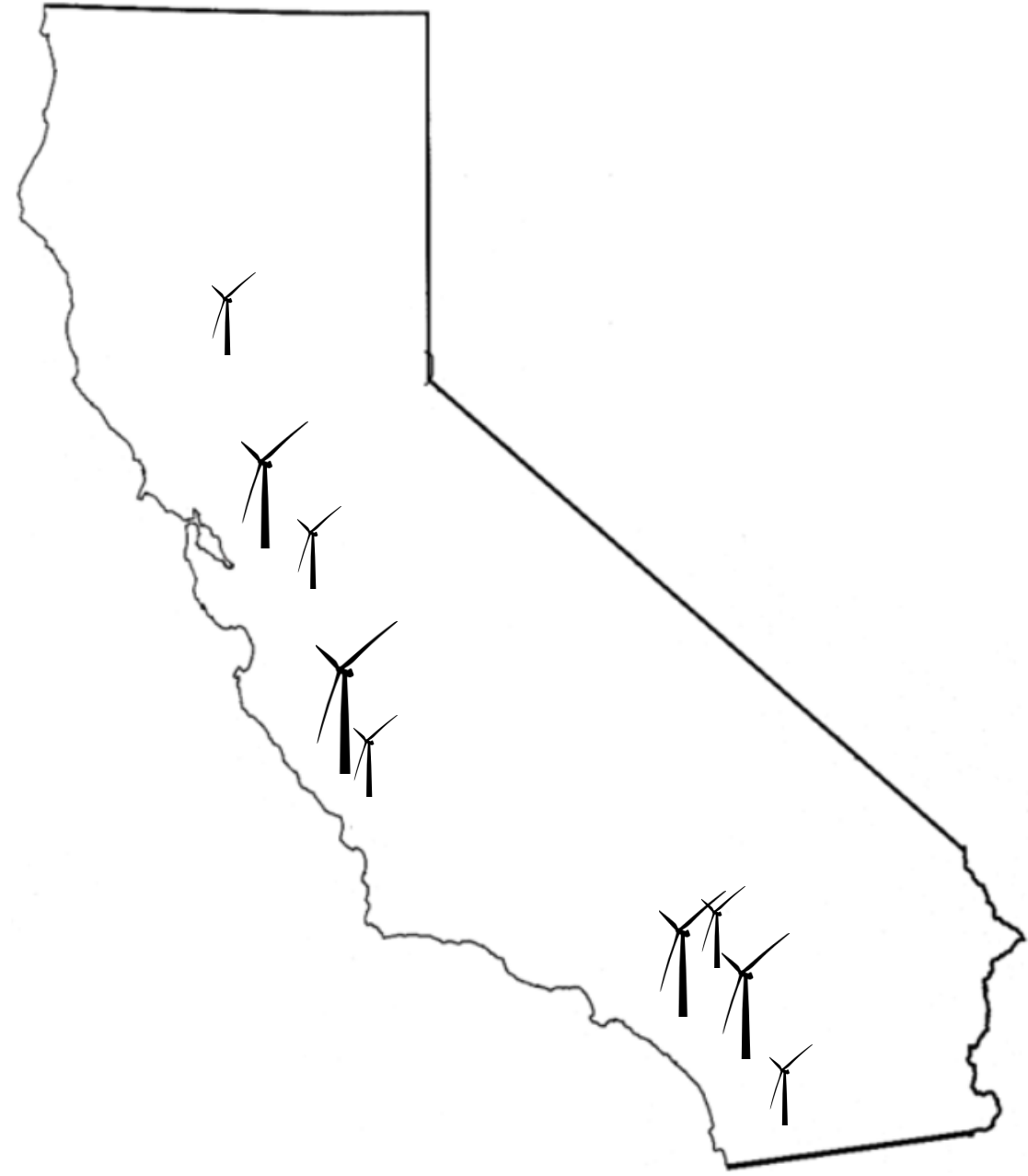
Workshop on Self-Generation Incentive Program Renewable Generation

November 12, 2020



Foundation Windpower California Projects

- 35 MW at 20 Commercial, Industrial, Agricultural Customer Sites
- Diverse Geographies and Customer Types:
 - Aggregate Rock Mines
 - Cement Manufacturing Facilities
 - Winery
 - Brewery
 - Agricultural Processing Facilities
 - CA State Prisons
 - Tribal Travel Center & Gaming Facility
 - Bottling Facility
 - Municipal Wastewater Treatment Facilities
 - Large Commercial Distribution Centers



NATURALLY ALIGNED TO PRODUCE WHEN NEEDED MOST: Sun heats central CA, pulling cooler air in from the coast, resulting in strong and predictable late afternoon and evening winds, offering a **natural solution to the “duck curve” problem**. This alignment with peak 4-9PM hours occurs statewide, but is particularly pronounced in Salinas Valley:

Average Foundation Windpower Project Capacity Factor: 30-35%

Average Foundation Windpower Project Capacity Factor, 4-9PM Jun 1 –Sep 30: **40-85%***

*Alignment with peak 4-9PM hours occurs statewide, but is particularly pronounced in Salinas Valley

A typical behind-the-meter wind NEM customer exports to the grid during peak hours, and draws back from it in the early morning hours.

Many deployed wind in part because of its unique ability to deliver peak heavy renewable power without requiring onsite storage.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	12X24 Wind Data: Average Project Output (kW)											
100	131.7	188.3	140.5	149.8	207.2	260.5	168.5	103.3	62.3	43.8	44.7	131.8
200	135.6	197.3	123.9	118.2	162.9	212.3	135.1	69.0	48.7	43.9	41.4	138.6
300	135.6	174.4	112.9	100.1	142.5	171.4	109.3	53.5	36.1	46.0	49.1	143.4
400	128.4	179.4	106.4	91.6	131.0	149.9	85.5	47.6	30.7	45.7	43.6	151.5
500	131.4	185.0	96.4	94.4	107.9	115.8	64.1	40.9	26.3	41.4	44.5	149.4
600	153.4	171.8	101.2	94.6	107.7	125.6	54.6	32.8	23.4	35.3	42.6	143.3
700	167.8	192.1	114.0	101.3	149.6	177.5	74.0	39.6	29.1	38.2	53.3	136.2
800	184.5	237.9	201.5	208.6	241.5	240.8	104.4	64.8	71.2	78.0	70.8	153.7
900	278.6	392.1	345.7	321.7	322.2	305.1	162.6	106.6	122.6	146.1	171.0	262.0
1000	401.1	476.8	389.2	404.9	442.7	453.4	297.3	179.8	166.2	186.4	249.8	405.3
1100	437.5	483.6	428.5	510.7	608.0	657.4	573.0	426.7	283.5	220.9	283.3	424.8
1200	453.5	488.3	528.3	644.5	782.0	848.3	867.2	767.3	520.5	323.0	320.1	425.1
1300	454.9	530.5	644.7	745.8	889.9	945.5	976.0	939.0	719.4	503.0	407.2	422.8
1400	515.9	602.3	740.4	819.8	940.6	989.7	996.8	975.7	878.6	661.6	523.1	454.3
1500	575.6	644.9	829.4	877.1	976.1	995.2	998.2	989.6	961.7	770.2	584.5	468.9
1600	589.2	672.3	875.7	925.3	985.3	997.5	996.7	995.1	986.7	831.3	648.5	475.0
1700	514.0	689.0	901.9	953.6	985.4	998.2	996.1	994.5	988.8	844.5	569.9	372.2
1800	394.7	605.4	893.7	944.6	983.2	997.5	996.5	993.5	965.4	776.0	481.9	286.2
1900	313.2	524.5	816.0	903.4	964.7	991.5	973.8	972.0	884.0	612.4	321.6	223.8
2000	189.4	404.1	634.9	760.8	869.4	941.8	910.0	897.7	646.0	355.1	168.3	169.4
2100	158.5	260.6	398.5	529.7	698.5	797.4	757.7	680.9	406.4	208.3	96.5	151.5
2200	134.6	210.5	247.6	366.8	495.2	626.2	530.3	446.4	254.7	111.1	67.7	138.1
2300	137.3	183.7	189.3	239.4	354.8	484.2	356.4	257.7	137.2	75.8	65.1	129.1
2400	131.9	183.5	166.5	180.0	260.6	331.2	238.8	152.8	80.3	48.4	50.5	124.8

Average Output / MW of Generation, FWP Salinas Valley Project, Peak Hours Circled

- **Geographic**: Must deploy where the load is – cannot chase the strongest wind resource.
- **Economics**: Cannot benefit from economies of scale seen at wind farms (*e.g.*, crane is constructed, used once, and disassembled).
- **Permitting**: Permitting simplicity does not scale down with project size (CEQA).
- **Interconnection**: Costs and timelines are increasing exponentially. Costs swamp small project economics.
- **Financing**: Uncertainty from the above factors + imminent expiration of federal tax credits for > 100kW wind.

Challenges: Permitting and CEQA

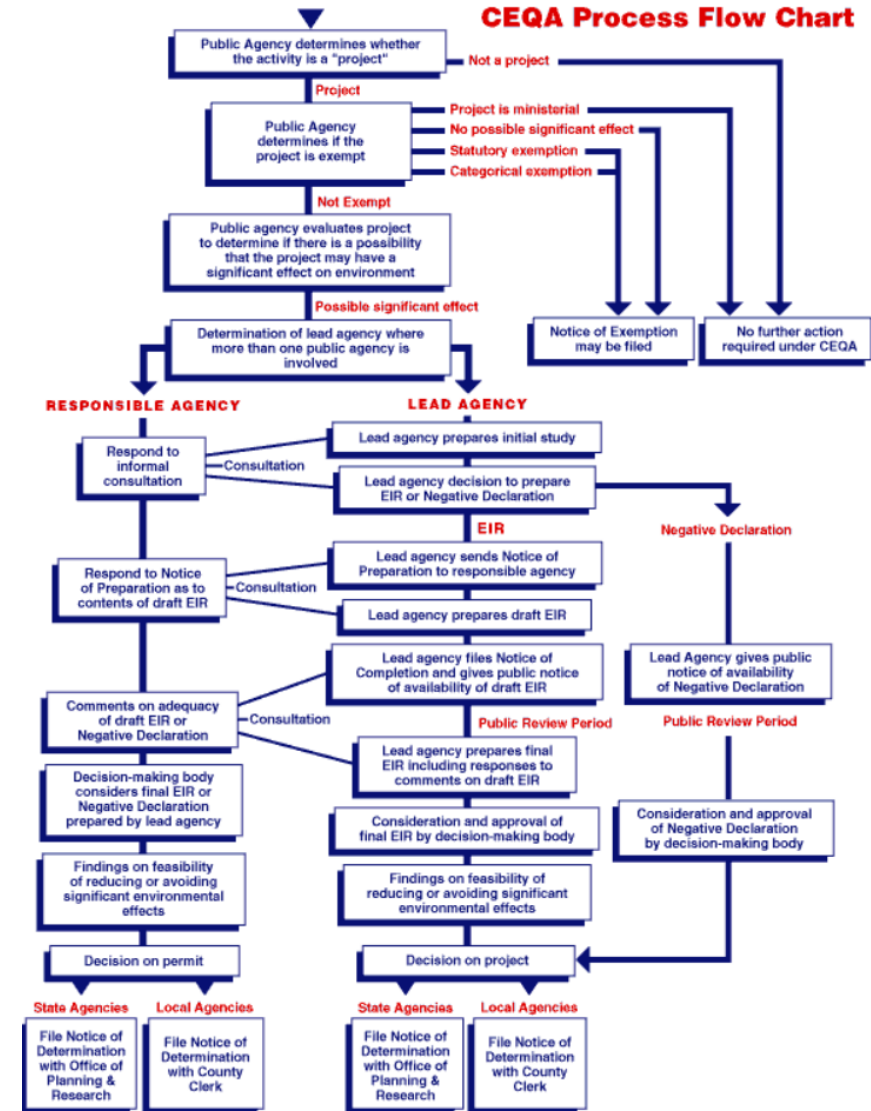
Wind projects require extended permitting timelines due to size and visibility.

Example: Most recently permitted project (2020) was well-positioned for straightforward environmental review and approval:

- Onsite wind facility within 5 miles of 5 other operating existing behind-the-meter wind projects.
- Ample biological study data available from previous permits
- Supportive community and permitting authority
- Permit issued with Mitigated Negative Declaration on 7-0 vote

Still, time from filing to issuance of permit was **18 months**, excluding any time for appeals. Delay could be much more significant if extended biological monitoring is required.

The unique and visible nature of wind projects results in extended permitting timelines for even the simplest, best-sited projects.



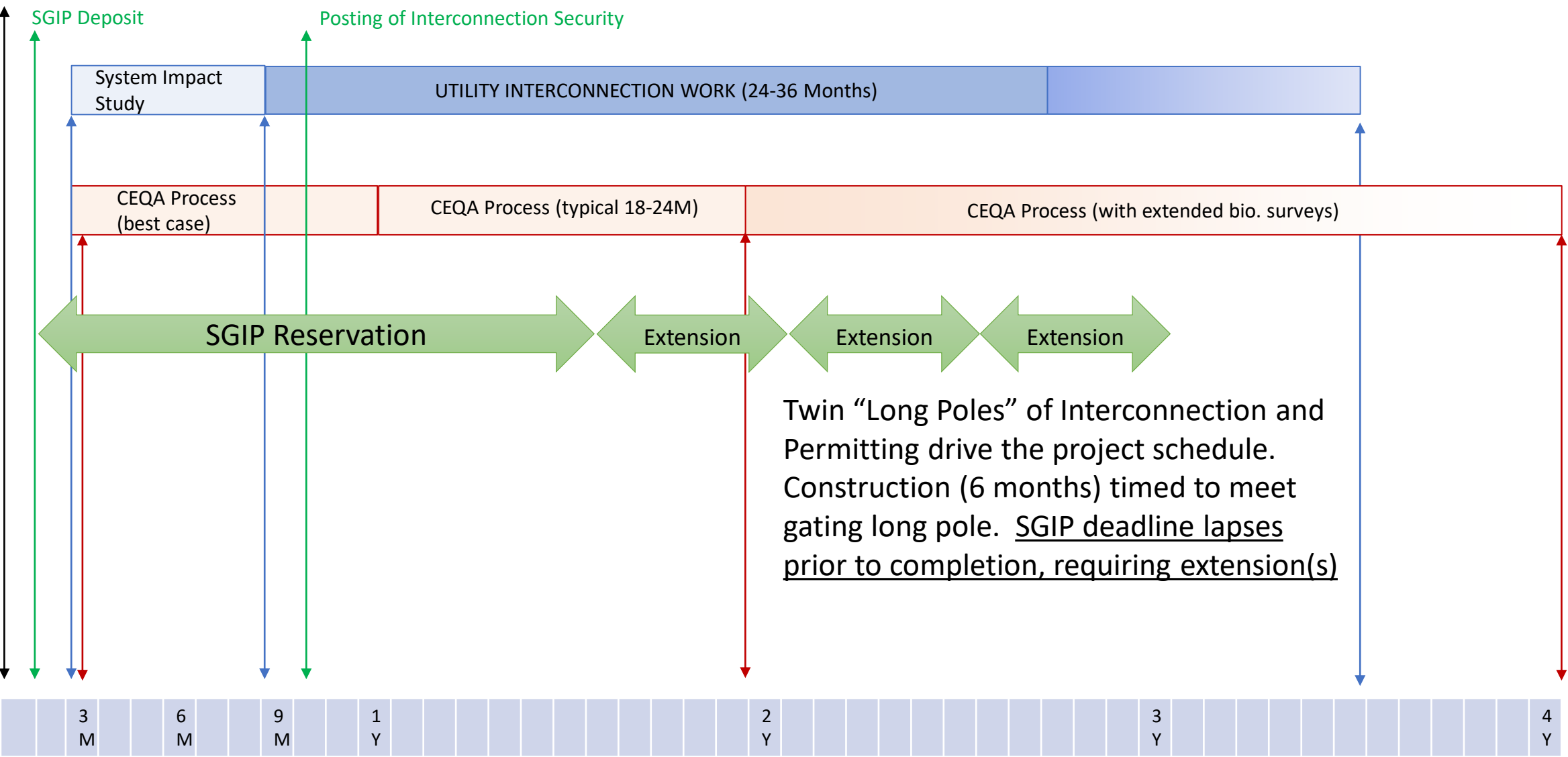
Challenges: Interconnection Cost and Delays

- Over last 10 years, cost to interconnect behind-the-meter wind to the grid has increased exponentially, particularly in PG&E service territory, as a result of unique grid protection requirements.
- Utility upgrade timelines create a bottleneck that threatens projects' viability by running out the clock on expiring federal tax credits and/or SGIP reservations
- Most recent behind-the-meter wind project is requiring **\$6M** in utility interconnection upgrades and **~30 months** for upgrades to be completed.

Challenges: Current Wind Behind the Meter Project Timeline



T=0: Decision to Proceed



SGIP Program Features Impacting Wind Energy Development

- First Come; First Serve Reservation Requests
- 5% Non-Refundable Deposit Due w/in 7 days of Reservation Request
- Reservation Expiration -- 18 mos. for 3-step reservations
- Up to three (3) 6-month extensions available at SGIP Working Group's Discretion
- 12/31/2022 – Potential Advice Letters for Budget Shifts Between Technology

SGIP & Wind Energy – Potential Responses to Current Challenges

- Improve Coordination of Incentive Claim Deadline with CEQA
 - Require applicant to file permit application w/in 60 days of confirmed reservation
 - Pause incentive claim clock during pendency of CEQA process
 - Grant PA's more authority to extend incentive claim deadline for CEQA
- Improve Coordination of Incentive Claim Deadline with Interconnection Process
 - Pause incentive claim clock during pendency of Utility's interconnection build-out
 - Grant PA's more authority to extend incentive claim deadline for interconnection
- SGIP deposit refundable if CEQA permit denied or cost-prohibitive interconnection, provided pursued in good faith